ICAO IP MOBILITY STUDY

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BACKGROUND

- Considering the dominate position of the Internet Protocol Suite (IPS) in the commercial networking environment, the Air Navigation Commission (ANC) concluded that consideration should be given to whether it was viable for aeronautical applications to make direct use of IPS in the aeronautical environment.

- The ANC gave the Aeronautical Communications Panel (ACP) Working Group N (Networking) the task to:

  - “consider the use of TCP/IP protocols in the provision of aeronautical internetworking”.

Working Group N Initial Report

- ACP Working Group N produced an initial report which was presented at the June 2005 ACP Working Group of the Whole Meeting. The report concluded that:
  - For Ground/Ground communications
    - use of the IPS appeared to be straightforward and further consideration was to be given with the aim of development of a minimum set of SARPs and Guidance Material necessary to support global interoperability.
  - For Air-Ground communications
    - technical issues, mainly related to mobility and security need to be resolved.

Working Group N Study

- Sub-groups N1 (Internetworking) and N4 (Security) initiated a joint study which analyzed a number of candidate ATN IPS communication solutions from a mobility and security perspective.
  - An initial set of candidate solutions was identified at a meeting held in Montreal in November 2005.
  - An initial set of Technical and Implementation Characteristics were defined which are used for analysis of each candidate solution.

Candidate Solution Types

- The initial candidate solutions identified were in four general areas:
  - using IETF mobile networking approaches,
  - applying IETF Inter-domain routing protocols or adapting ISO Inter-domain routing protocols,
  - performing mobility at the transport layer, and
  - performing mobility at the application layer.

Initial Candidate Solutions

- The IETF mobile networking solutions are:
  - Mobile IPv6 (MIPv6)
  - Network Mobility (NEMO)
- The routing solutions are:
  - the IETF inter-domain routing protocol (BGP),
  - the ISO inter-domain routing protocol (IDRP) and
  - the IETF intra-domain routing protocol (OSPF).
- The transport layer solution is:
  - The Stream Control Transmission Protocol (SCTP)
- The application layer solutions are:
  - the IETF Instant Messaging protocols
    - Extensible Messaging and Presence Protocol (XMPP)
    - Session Initiation Protocol for IM and Presence Leveraging Extensions (SIMPLE)
  - an ATN Application Mobility solution

Additional Candidate Solutions from the Eurocontrol Study

- A Link Layer solution:
  - Uses the 3GPP/UMTS Specification
- An additional Network Layer solution
  - IPsec Tunnel Movement

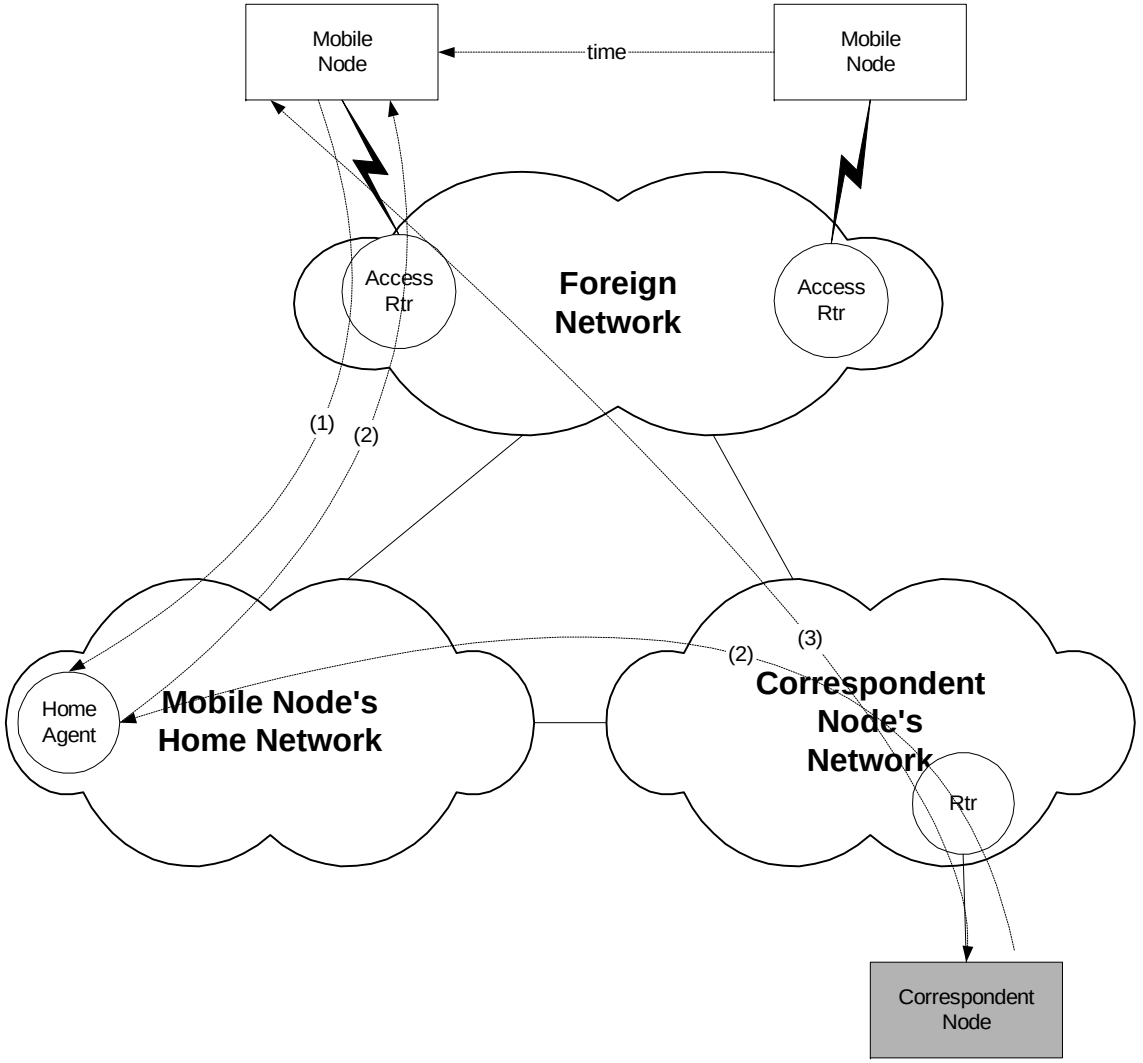
Air/Ground Study Results

- The transport layer solution does not appear to be a viable solution.
  - SCTP is a standard that was not designed for mobility
    - this type of use is not directly supported by the standards documents or available vendor implementations
- The application layer instant messaging solutions also do not appear to be viable solutions.
  - Neither XMPP nor SIMPLE is directly designed to provide the type of smooth mobility required
- The ATN application layer solution could be applied.
  - An application based approach to mobility has the advantage of a simplified network layer; however, it does not take advantage of COTS solutions.

Air/Ground Study Results

- The IETF mobile networking solutions (Mobile IP and NEMO) appear to hold promise for the long term.
  - However work in this area is still evolving especially to solve the problem where the Home Agent is not local
  - Work has been initiated in the NEMO Working Group to address route optimization requirements for Aeronautics and Space Exploration Mobile Networks
    - See http://tools.ietf.org/html/draft-eddy-nemo-aero-reqs-00

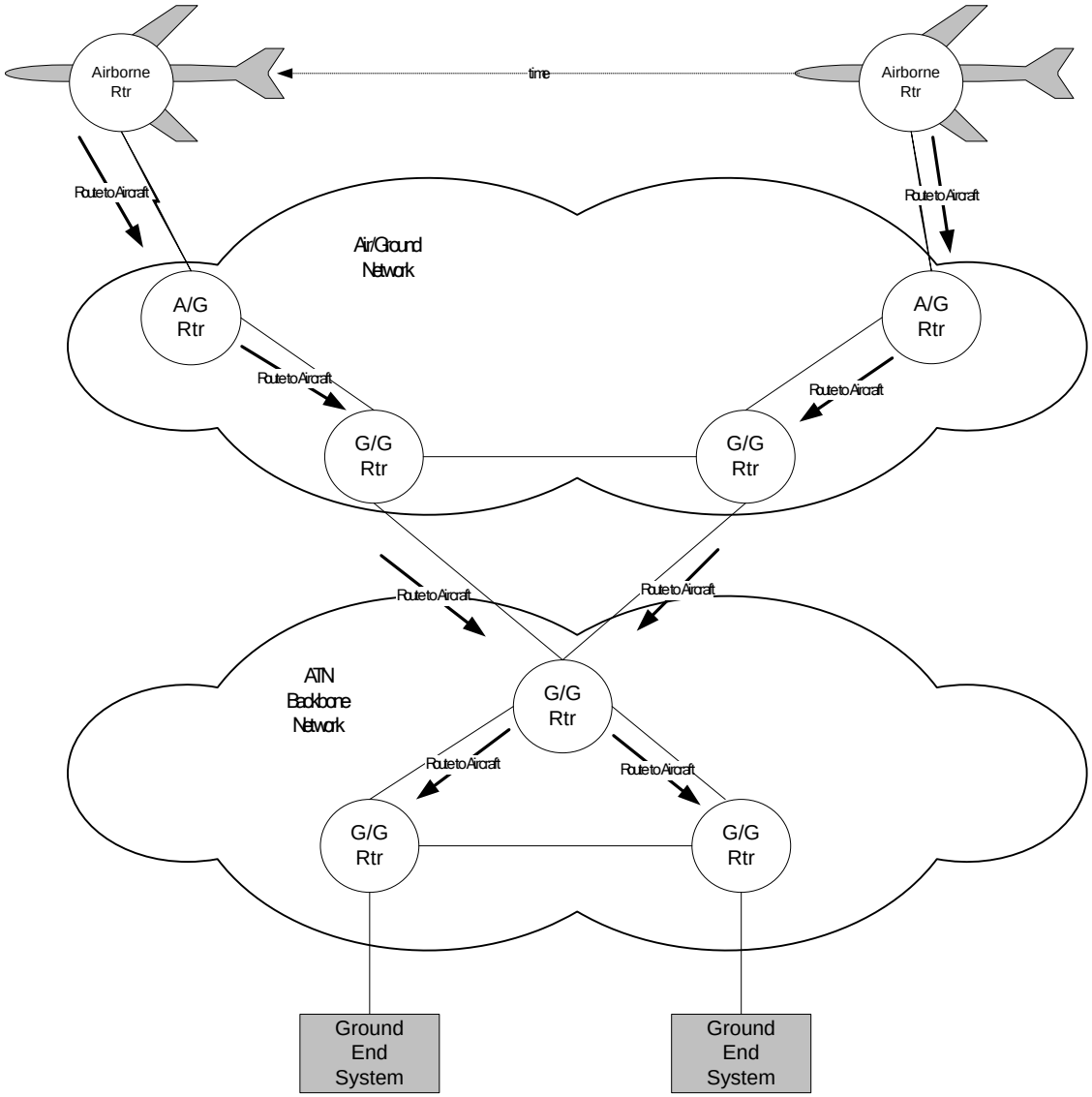
Mobile IP


Mobile Node
time
Mobile Node
Access Rtr
Foreign Network
Access Rtr
(1)
(2)
(2)
(3)
Home Agent
Mobile Node's Home Network
Correspondent Node's Network
Rtr
Correspondent Node

Air/Ground Study Results

- The routing solutions could be applied.
  - IDRP would also work; however, the community would still be left with an aviation-specific solution.
  - OSPF would also work if applied on a single routing domain; however, there may be administrative issues since it is expected that the ATN will be operated by multiple service providers and administrations.
  - BGP has the advantage that it is similar to the current IDRP routing approach and thus would make transition easier

Mobility through Routing



Air/Ground Study Results

- The IPSec Tunnel Movement mobility approach is a COTS solution.
  - It exploits the fact that IPSec tunnels protect against identified threats and, at the same time, provide a mobility solution by moving the tunnels.

- The Link Layer mobility option can work and is based on a COTS solution using the 3GPP/UMTS specifications.

Air/Ground Study Conclusion

- Mobility in an IPS environment is feasible.
- The ACP intends to select one or more of these solutions and develop SARPs and Technical Provisions by the end of 2008.